Missouri River Cottonwood Study

A Scientific Approach to develop a landscape-scale index model

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Photo by Tim Cowman

Bald Eagle

Photo by Jim Rathbert

Least Tern

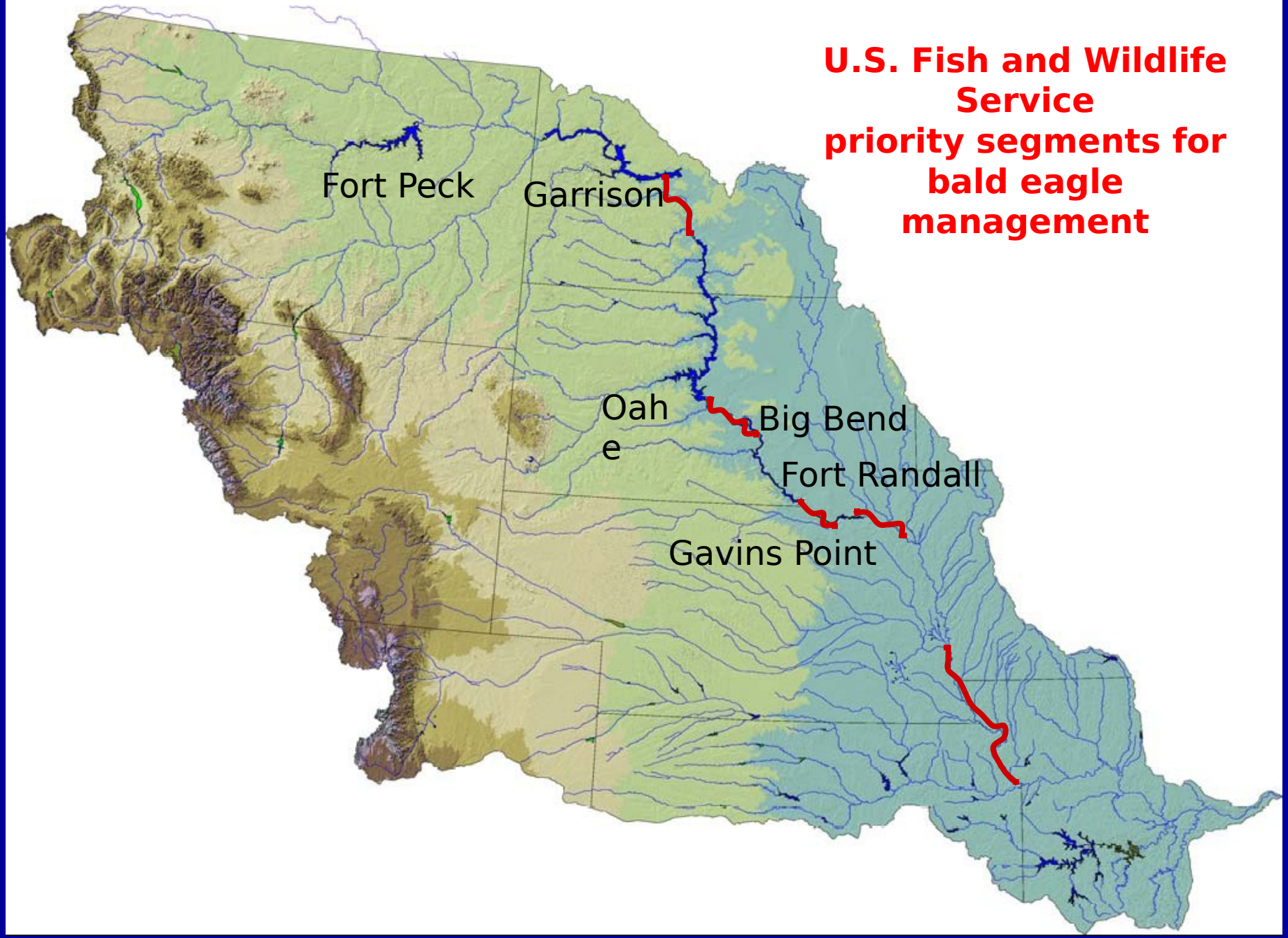
Piping Plover

Photo by Chris Gondahl

Pallid Sturgeon

Bald Eagle Reasonable and Prudent Measures (RPM's)

- Map and evaluate current health of cottonwood forest that could provide bald eagle habitat
- Develop a Cottonwood management plan
- Ensure no more than 10% of existing suitable habitat is lost for bald eagles


U.S. Fish and Wildlife Service priority segments for bald eagle management
Fort Peck
Garrison
Oahe
Big Bend
Fort Randall
Gavins Point

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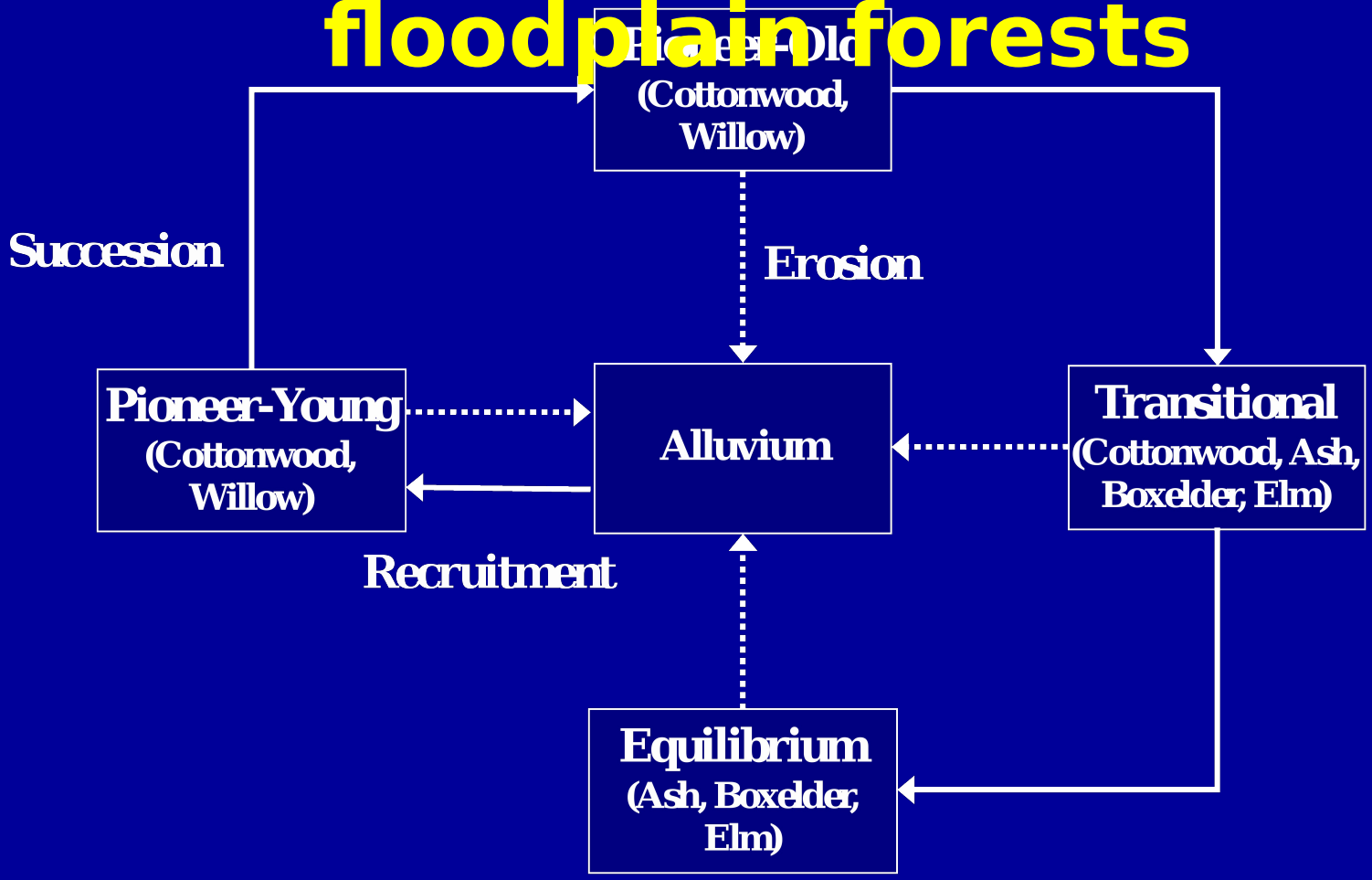
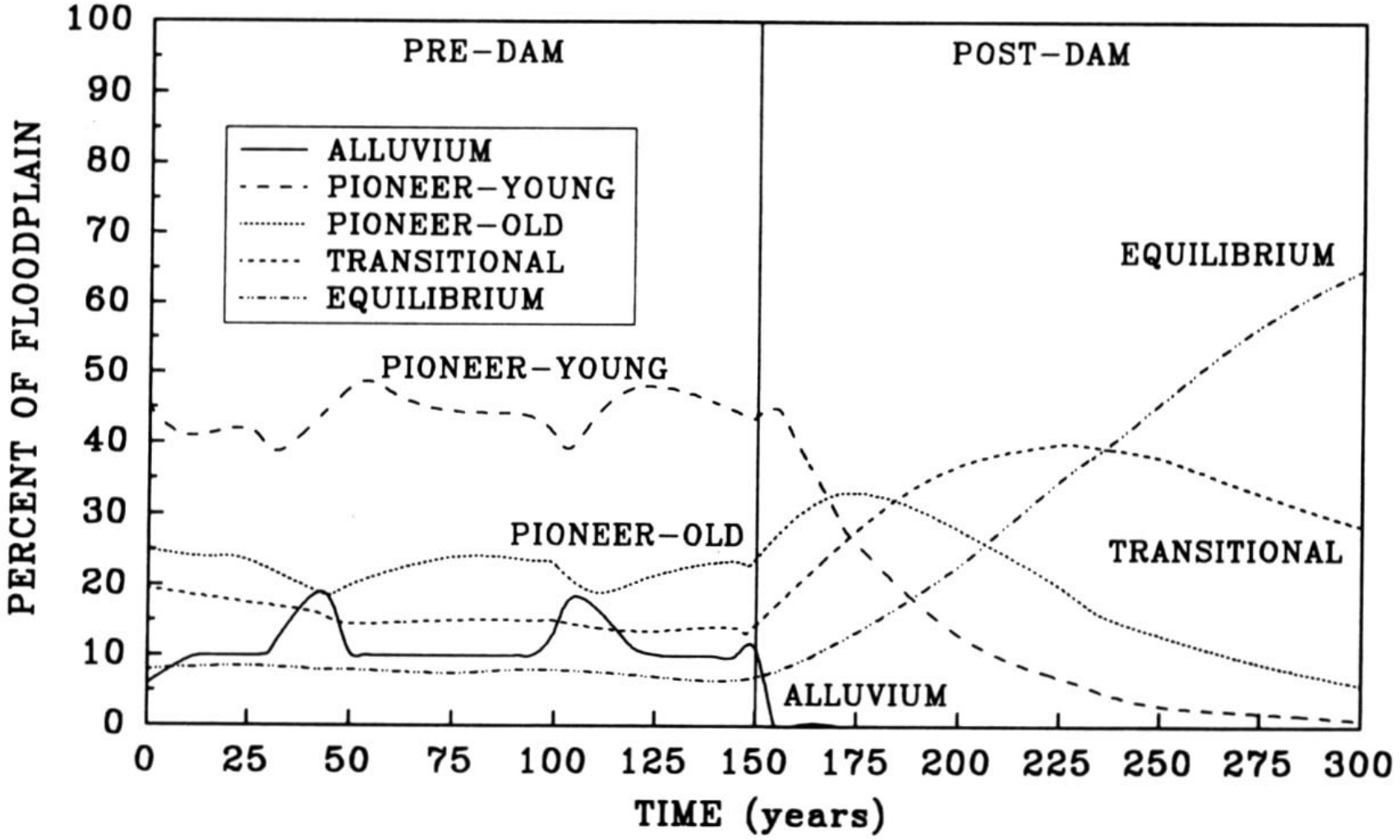
Conceptual Model of Succession in Missouri River floodplain forests



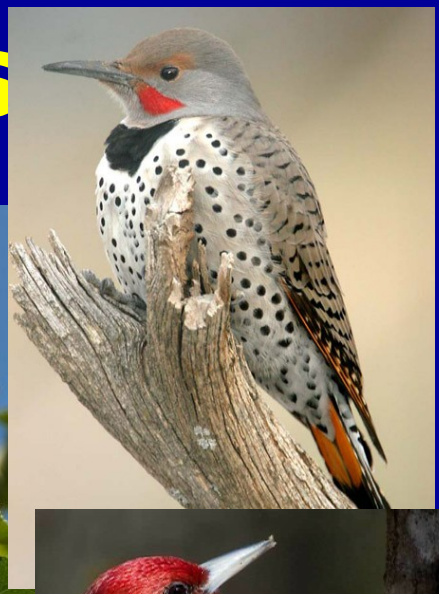
(adapted from Johnson 1992)

Projections of Cottonwood Succession Model for Garrison Reach, ND (Johnson 1992)



Why Cottonwoods

- Songbirds such as American goldfinches, yellow warblers, and ovenbirds feed and nest in young cottonwood forests.
- Bird species often found in older cottonwood forests include Northern orioles, mourning doves, warbling vireos, and Eastern kingbirds.
- Cottonwood woodlands support more cavity nesting birds (i.e., woodpeckers) than green ash, juniper, or bur oak woodlands
- Cottonwood trees fall into the river and backwaters, where the trees provide woody debris for fish and macroinvertebrates



Interdisciplinary Team

- Corps of Engineers - Omaha and Kansas City Districts, Engineer Research and Development Center
- National Park Service
- Natural Resource Conservation Service
- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

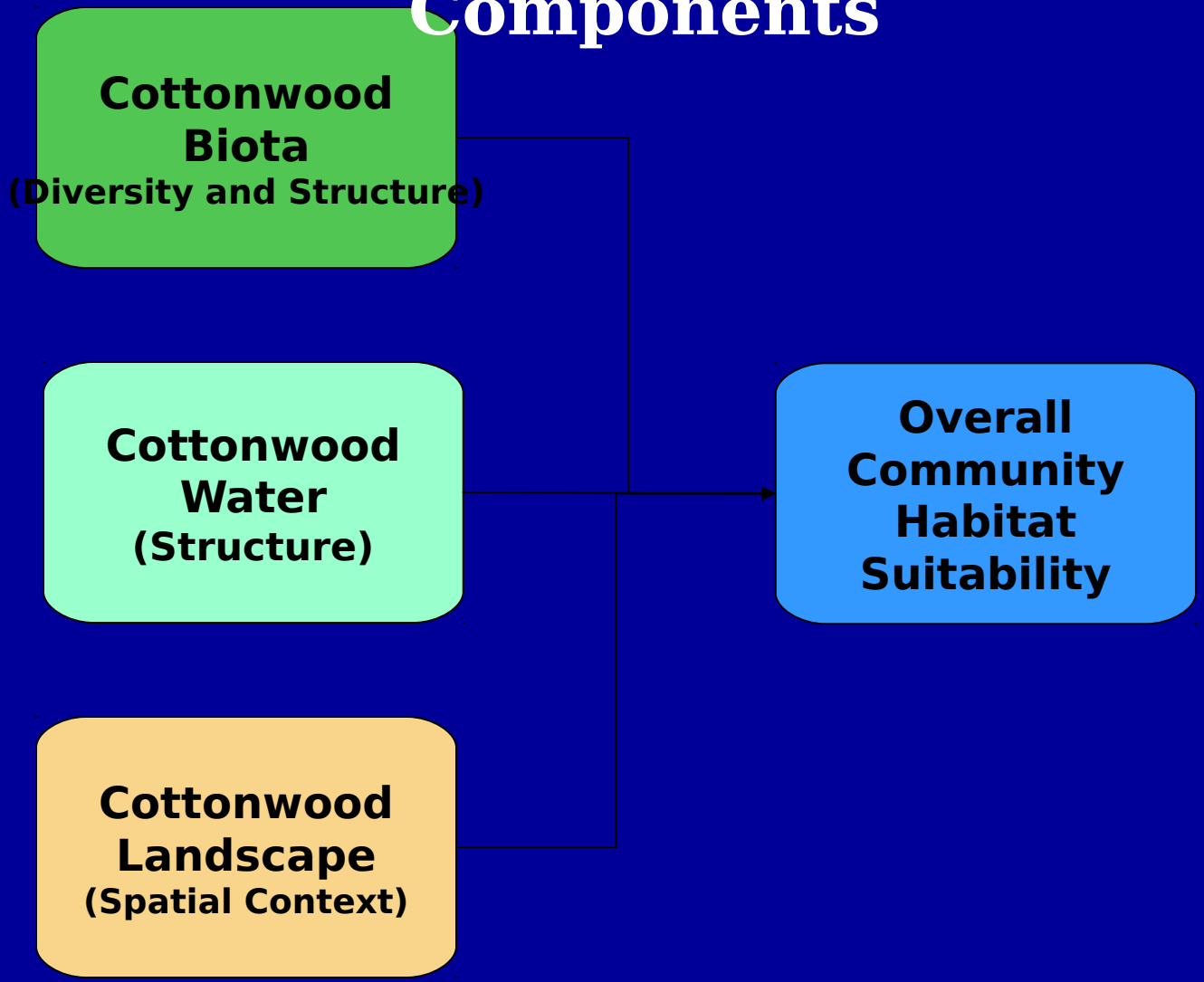
- Iowa Department of Natural Resources
- Kansas Department of Wildlife and Parks
- Lewis & Clark Natural Resource District
- Missouri Department of Conservation
- Nebraska Forest Service
- Nebraska Game and Parks Commission
- South Dakota Department of Game, Fish, and Parks
- South Dakota Department of Agriculture

- Cheyenne River Sioux Tribe
- Lower Brule Sioux Tribe
- Omaha Tribe
- Pine Ridge Agency (Oglala Sioux Tribe)
- Rosebud Sioux Tribe
- Winnebago Tribe of Nebraska

- Benedictine College
- South Dakota State University
- University of Nebraska
- University of South Dakota
- USD - Missouri River Institute

- Izaak Walton League of America
- The Nature Conservancy

Cottonwood Community Model Components



The Challenging Issues:

1) Argue over what the river historically looked like rather than focusing on what the future vision should be.

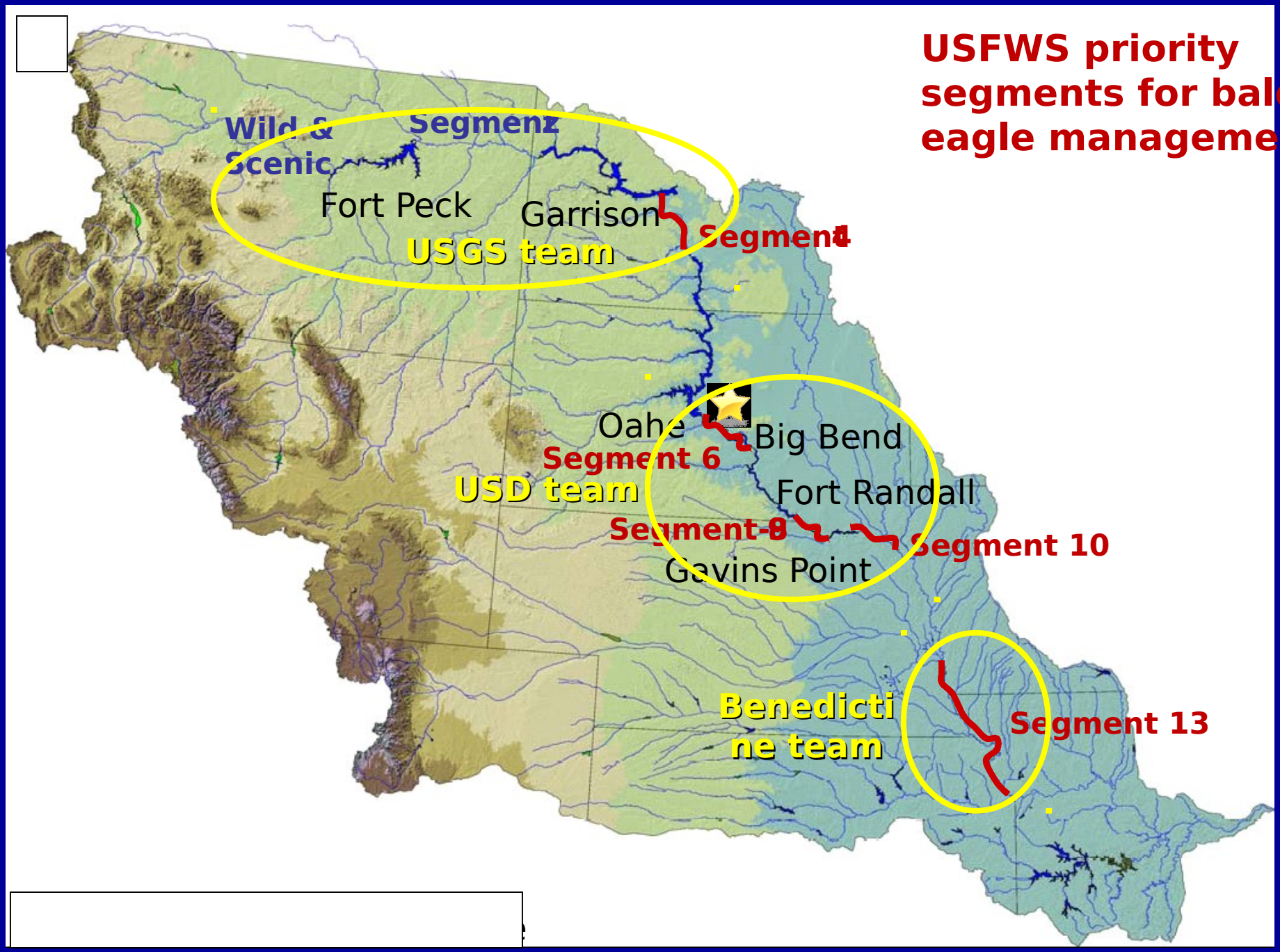
2) Model certification requirement and Credibility Issues

- How do we incorporate science into our planning process?
- Many Corps reports rely heavily on other “agency reports over primary literature”
- Current literature doesn’t always provide decision makers with enough information to really forecast future conditions.

How do we address these Challenging Issues?

Challenging Issue #1 – This presentation will show mapping and vegetative collection efforts and how that assists in predicting trends. It can help our team focus on the future without condition rather than just argue about which snapshot in time we want to discuss.

Challenging Issue #2 – We have academia and USGS help conduct the studies and produce the literature we need to answer key ecological questions that will help us as decision makers.


USFWS priority segments for bald eagle management
Wild & Scenic
Segment 2
Fort Peck
Garrison
Segment 4
USGS team
Oahe
Big Bend
Segment 6
USD team
Fort Randall
Segment 9
Segment 10
Gavins Point
Benedictine team
Segment 13

Missouri River Cottonwood Project

- BIOTA: Quantify age distribution, structure, composition, and condition of cottonwood forests on segments of Missouri River (MT, ND, SD, NE, IA, MO, KS)

  I. GIS Mapping: Forest Age Distribution and Historic Landscape Change

  II. Vegetation Sampling: Stand Characteristics by age class (approx. 30 stands per reach)

- HYDROLOGY: Hydrologic Mapping by USGS

  I. Land Capacity Potential Index: Created by overlaying elevation soil and wetness classes.

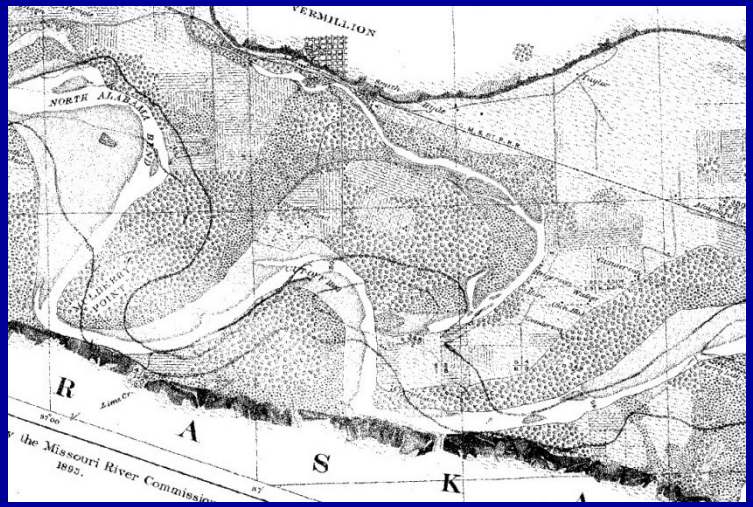
BIOTA:
I. GIS Forest Mapping

Use historic maps (1890s) and aerial photos (1956, 2006) in ArcGIS to:

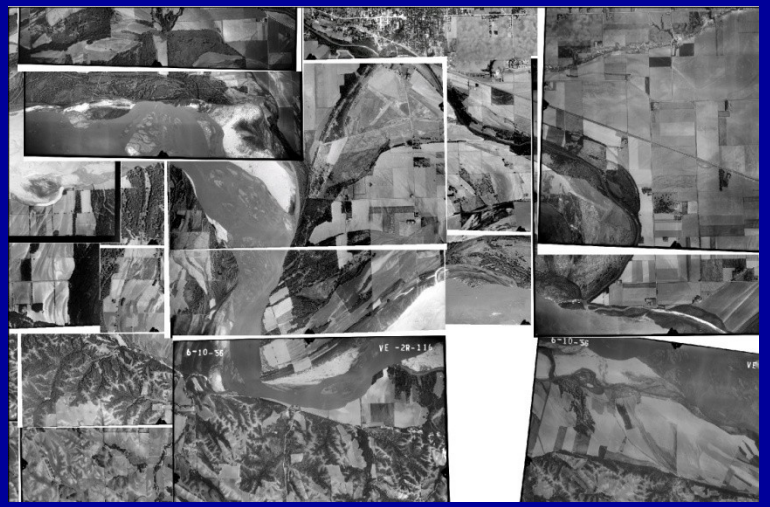
- Quantify pre- (1890s-1956) and post-dam (1956-2006) landscape changes
  - Area changes and transitions
- Map age distribution of forest stands (0-10 yrs, 10-25, 25-50, 50-100, >100 yrs)
  - Current age distribution and trajectory of future change

Historic Landscape Change

1890s

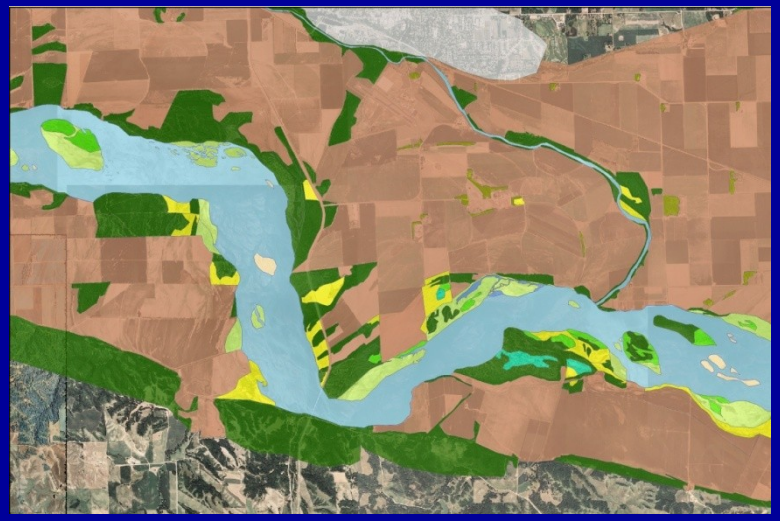


1956

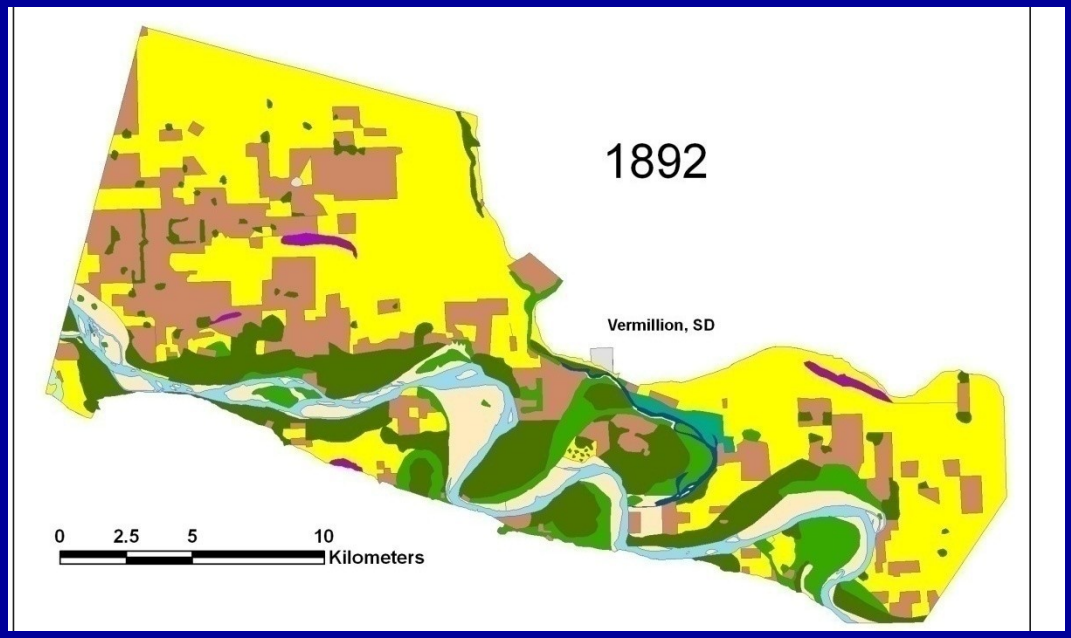


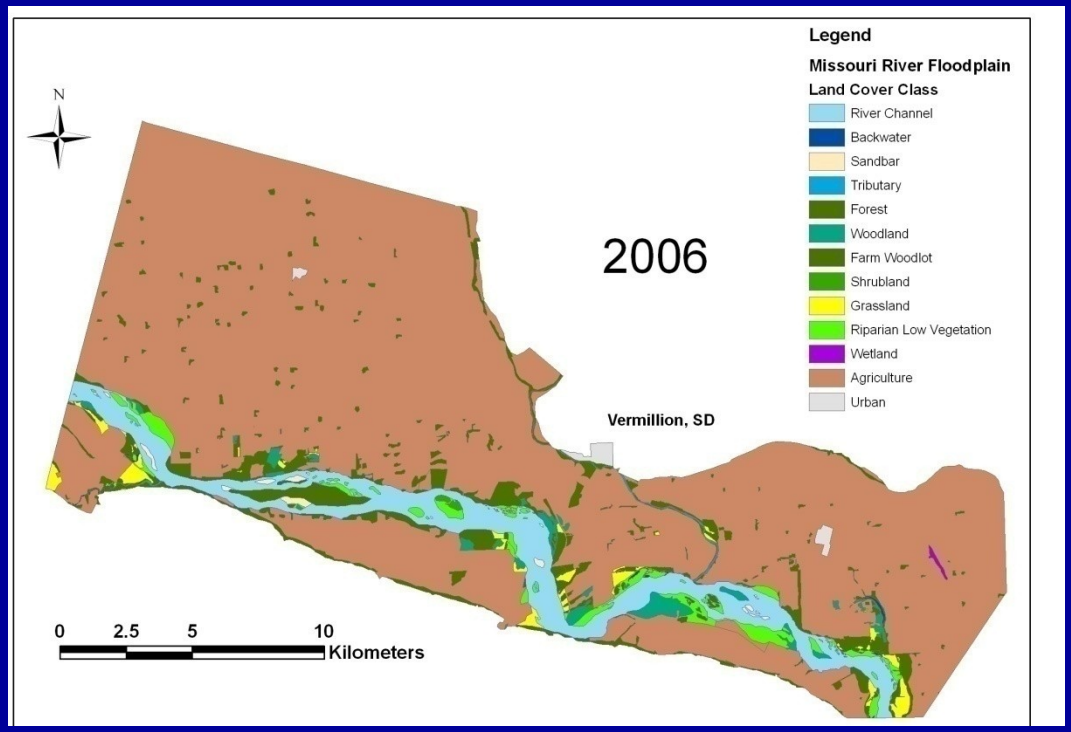
1980s

2006

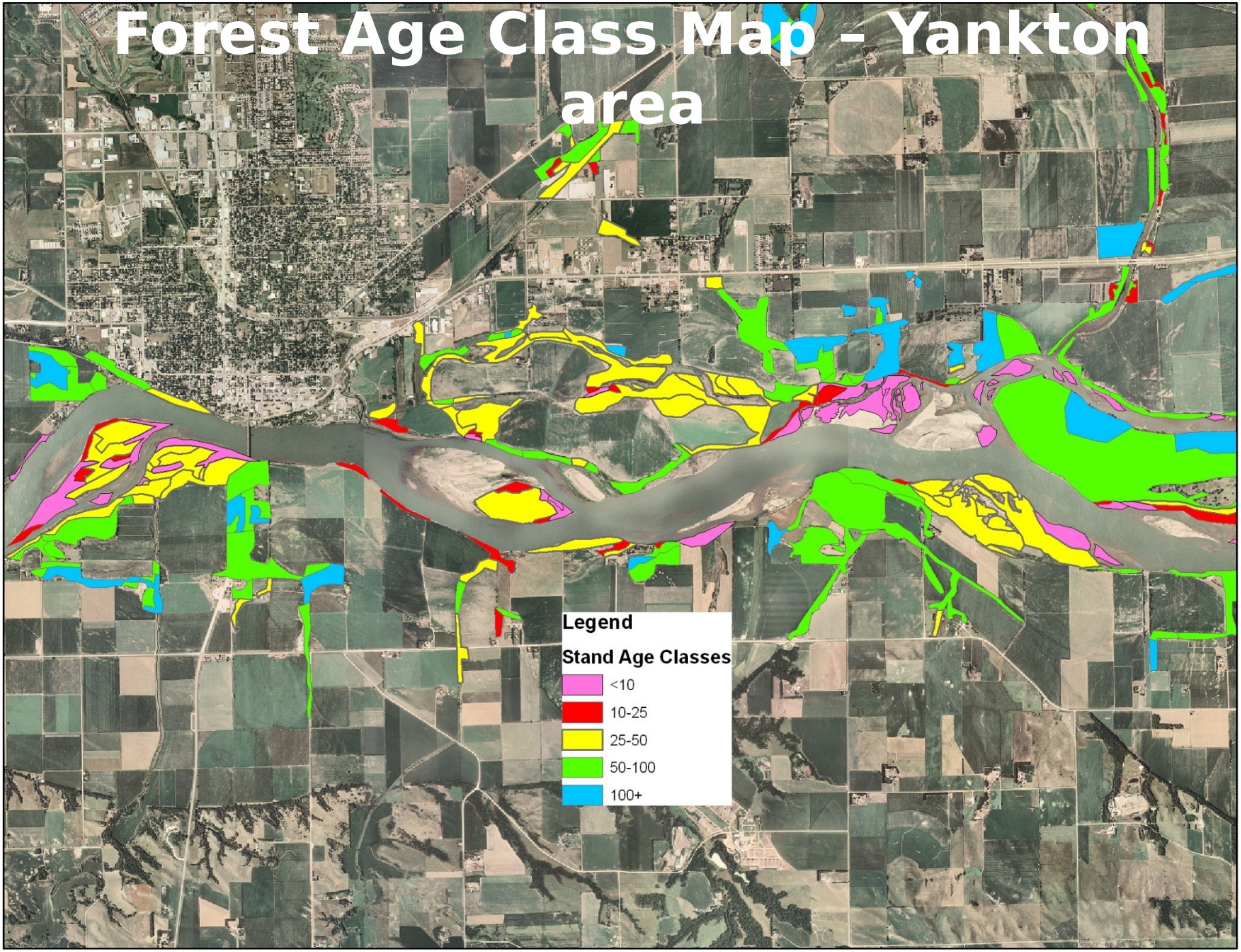


Historic Land Cover Change (1892-2006) in Missouri River floodplain near Vermillion, SD





Forest Age Class Map – Yankton area



BIOTA:
II. Vegetation Sampling

Quantify veg. characteristics by stand age class

- Trees, Shrubs, Herbs are sampled for:
  - Structure, species composition
  - Metrics of wetland affinity, floristic quality, diversity, native vs. exotic dominance

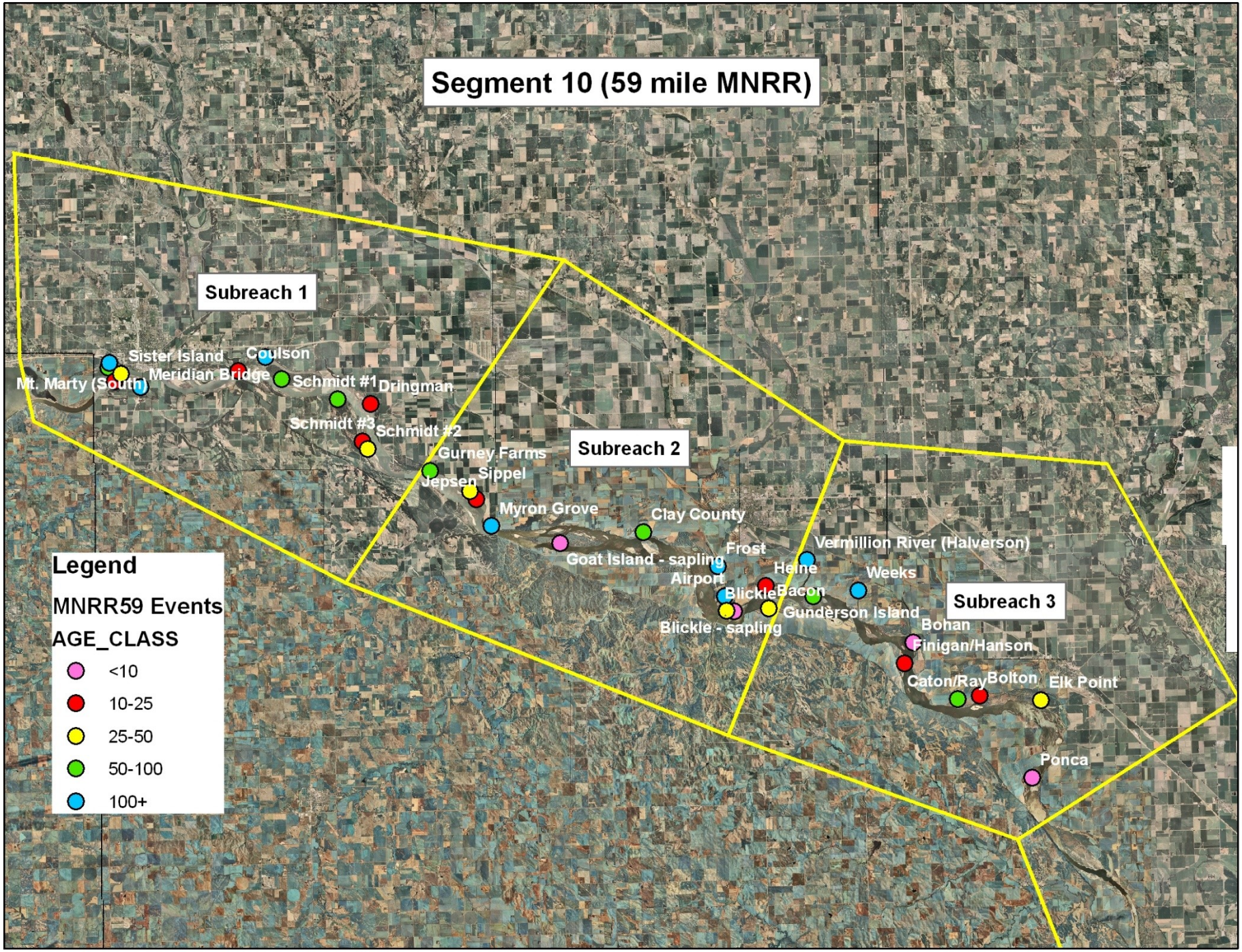
    - **Trees** (woody, dbh >10 cm, height > 1m)
      - Point-centered quarter method (40 pts per stand, 160 trees)
      - Trunk diameter, density, basal area, relative abundance

    - **Shrubs** (woody, dbh < 10 cm, height >1m)
      - 2 x 10 m Line intercept / belt transect (12 per stand)
      - % cover, stem density, by species

    - **Herbs** (non-woody or height <1m)
      - 1 x 1 m quadrat (24 per stand)
      - % cover by species
      - Species richness, wetland affinity, floristic quality, native/exotic

BIOTA:
II. Vegetation Sampling

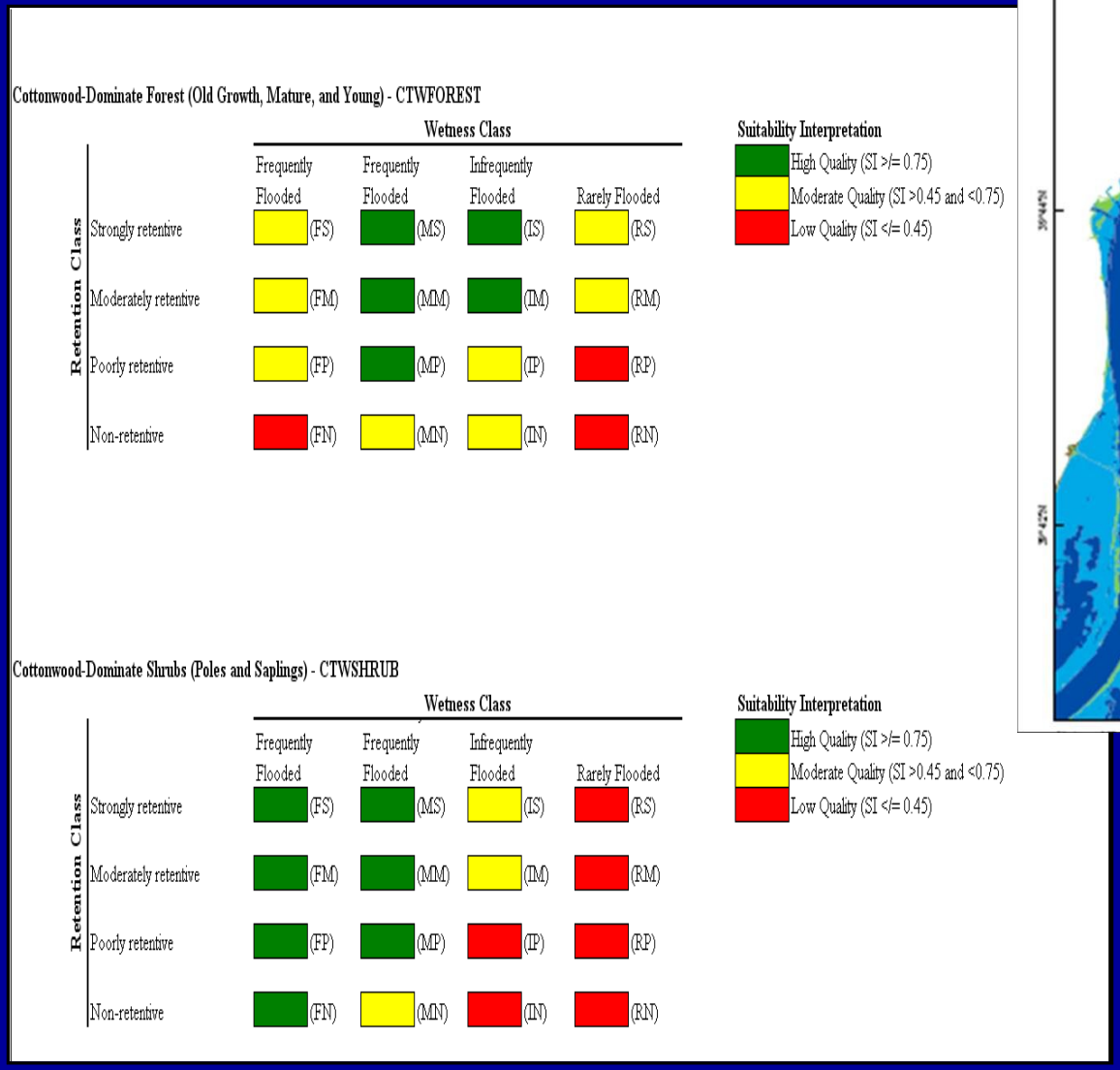
- Sampling Design:
  - Sample approx. 30 stands per river segment
  - 6 stands per age class (<10, 10-25, 25-50, 50-100, >100 yrs) per segment
- Six priority segments, approx. 180 sample points for project
- >30 parameters measured
  - Diversity
  - Species ID
  - Canopy cover
  - DBH

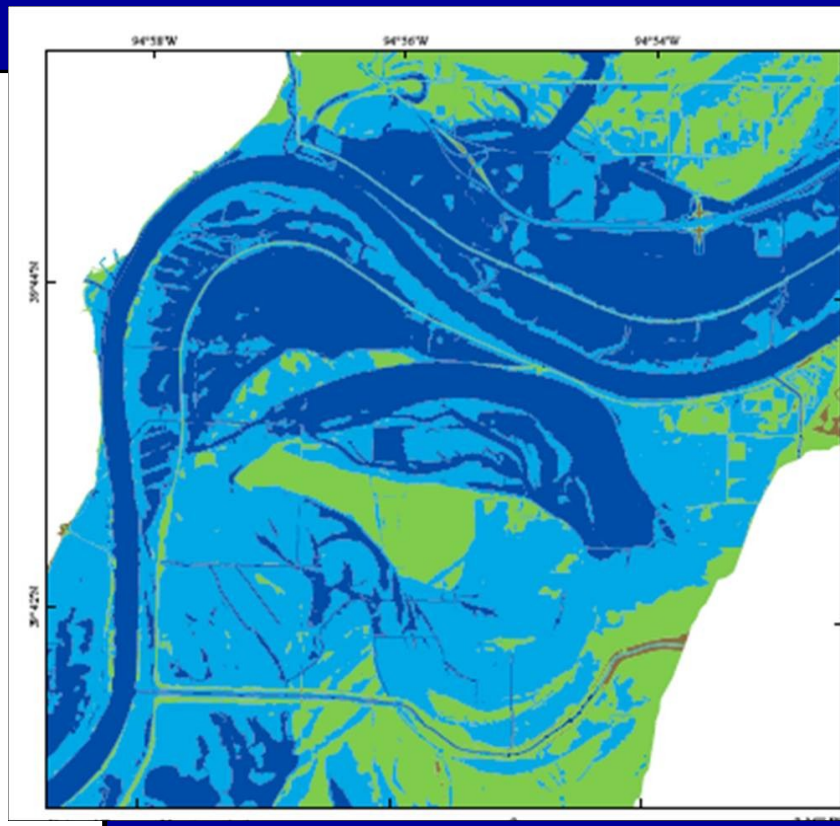

Segment 10 (59 mile MNRR)
Subreach 1
Subreach 2
Subreach 3
Sister Island
Coulson
Meridian Bridge
Mt. Marty (South)
Schmidt #1
Dringman
Schmidt #3
Schmidt #2
Gurney Farms
Sippel
Jepsen
Myron Grove
Clay County
Goat Island - sapling
Frost
Airport
Heine
Vermillion River (Halverson)
Weeks
Blickle
Bacon
Gunderson Island
Blickle - sapling
Bohan
Finigan/Hanson
Caton/Ray
Bolton
Elk Point
Ponca
Legend
MNRR59 Events
AGE_CLASS
<10
10-25
25-50
50-100
100+

Applications of Forest GIS Mapping & Vegetation Sampling

- Document patterns of plant species composition and stand structure within riparian forest stands
- Determine age structure of cottonwood patches in present day floodplain, with implications for future trajectory
- Data will be used to calibrate the Biota component of the Cottonwood Community / Landscape Assessment model developed by USACE

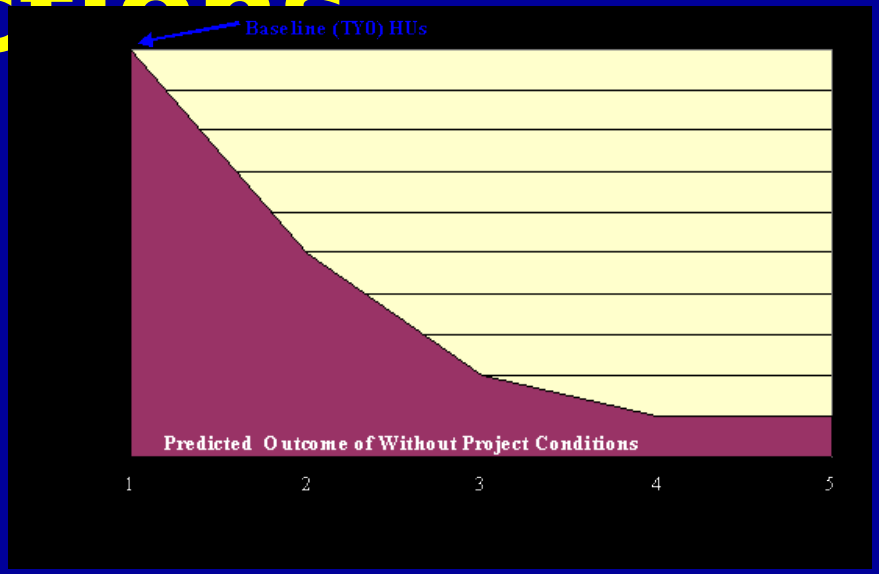
Linking Landscape Scale Hydrologic Modeling into the Community Habitat Model

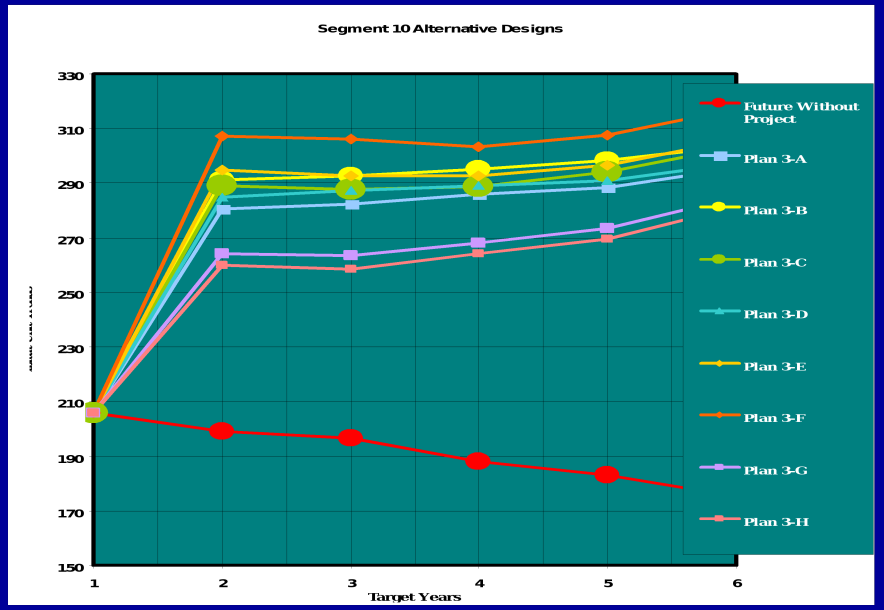

Cottonwood-Dominate Forest (Old Growth, Mature, and Young) - CTWFOREST
Wetness Class
Frequently Flooded
Frequently Flooded
Infrequently Flooded
Rarely Flooded
Retention Class
Strongly retentive (FS) (MS) (IS) (RS)
Moderately retentive (FM) (MM) (IM) (RM)
Poorly retentive (FP) (MP) (IP) (RP)
Non-retentive (FN) (MN) (IN) (RN)
Suitability Interpretation
High Quality (SI >/= 0.75)
Moderate Quality (SI >0.45 and <0.75)
Low Quality (SI </= 0.45)
Cottonwood-Dominate Shrubs (Poles and Saplings) - CTWSHRUB
Wetness Class
Frequently Flooded
Frequently Flooded
Infrequently Flooded
Rarely Flooded
Retention Class
Strongly retentive (FS) (MS) (IS) (RS)
Moderately retentive (FM) (MM) (IM) (RM)
Poorly retentive (FP) (MP) (IP) (RP)
Non-retentive (FN) (MN) (IN) (RN)
Suitability Interpretation
High Quality (SI >/= 0.75)
Moderate Quality (SI >0.45 and <0.75)
Low Quality (SI </= 0.45)



Future Condition Predictions

- Forecasting future conditions
  - Vegetation
  - Land use
  - Urbanization
  - Water resources
- Future without project conditions
  - No Action analysis
  - Cumulative Effects analysis
- Future with project conditions
  - Using historic data as a target for restoration





Key Take-Away Points

- If your challenging issue is…..
  - Describing the past quantitatively
  - CONTRACT WITH USGS & ACADEMIA
- If your challenging issue is…..
  - Model certification fears on a large watershed study
  - CONTRACT WITH USGS & ACADEMIA
- If your challenging issue is…..
  - Simply reducing the amount of gray literature and incorporating more peer reviewed literature into your management plans or studies
  - CONTRACT WITH USGS & ACADEMIA

Why USGS & Academia?

- USGS is recognized as a federal research agency
- Academia adds credibility to the process
- Use of certified models for all planning activities is mandatory - (EC 1105-2-407), so why not incorporate some peer review and primary literature in the beginning of the process?
- BOTH entities – Have a staff of scientists that live to research and publish meaningful literature

Why Contract and How?

- Because just setting up an interdisciplinary team and “hoping” folks have the time to dedicate to your project leads to project delays….everyone is stretched too thin.

- Issue a scope of work/contract so you get the deliverables.

- Work with your Contracting Division to find the best way to reach these entities. Contract via MIPR’s, create MOU’s with Universities

Research Team Members

- Lisa Rabbe (Bald Eagle / Cottonwood Program Leader) – USACE
  - Kristine Nemec (Omaha District), Kelly Burkes-Copes & Tisa Webb (ERDC)
- Dr. W. Carter Johnson (Cottonwood/Vegetation Project Leader) - SDSU
- Dr. Mark Dixon (Cottonwood/Vegetation Project Coordinator), Rebekah Jessen & Caleb Caton (Grad students) – USD
- Tim Cowman – (Hydrologist) - SD Geological Survey / Missouri River Institute (USD)
- Rob Jacobson – (Hydrologic mapping (LCPI)) – USGS, Columbia, MO
- Dan Bowen, Martin Simon, J. Davis, Terry Malloy (Sample Platte to Kansas River reach (Segment 13)) – Benedictine College
- Michael L. Scott and Elizabeth Reynolds (Sample Montana and North Dakota reaches, some GIS) – USGS, Fort Collins, CO

Other Key Contributors

- Suzie Boltz (Lead Programatic EA/Cottonwood Management Plan publication) - EA Engineering
- Gary Larson (Plant identification expert) – SDSU
- USD Undergraduate Students:
  - Wes Christensen and Heather Campbell (GIS Technicians)
  - Adam DeZotell, Eric Dressing, Alyssa Hotz, Drew Price, Jennifer Young (undergrad research assistants)
- Stephen Wilson – NPS, Missouri National Recreational River
- Ed Rodriguez and Mike Bryant – USFWS, Karl Mundt NWR
- Theresa Smydra – Missouri River Futures / NRCS
- Clarence Montgomery – Yankton Sioux Tribe
- Numerous private landowners along the Missouri River